Evaluation of Differences in Vehicle Response within the Tech 5 Data

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BP
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Outline

- Objective
- Description of work
- Results
- Observations
- Concerns about process

Objective

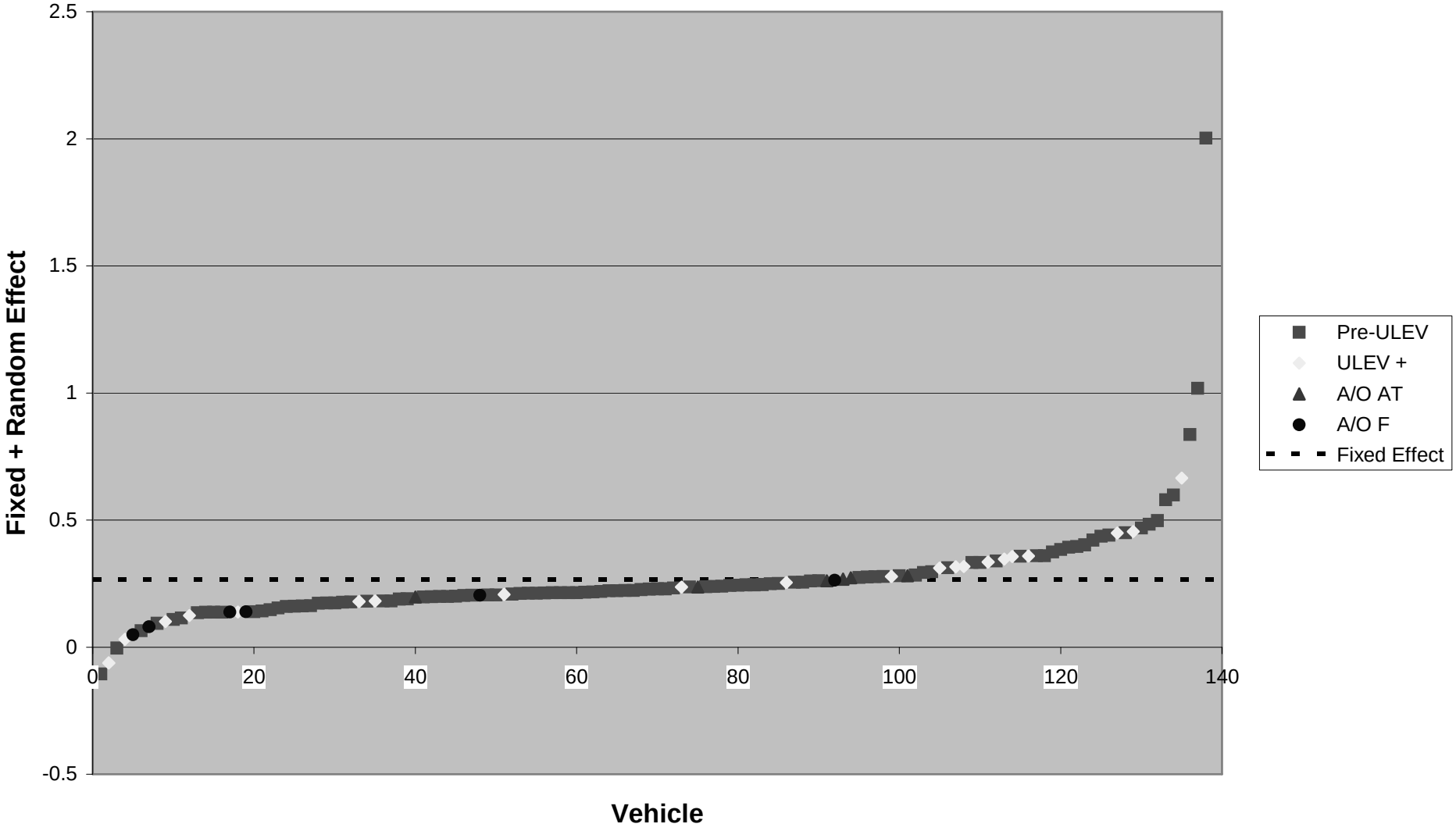
- Question: What is the proper definition of Tech 5 vs. Tech 4?
- Proposal: Tech 5 = ULEV and lower emissions
- Do “ULEV+” actually respond differently to fuel changes?
  - Intercepts not a determining factor
- Problems with comparing model results
  - Subsets have different vehicles tested on different fuels
  - Vehicles and fuel properties confounded

Description of work

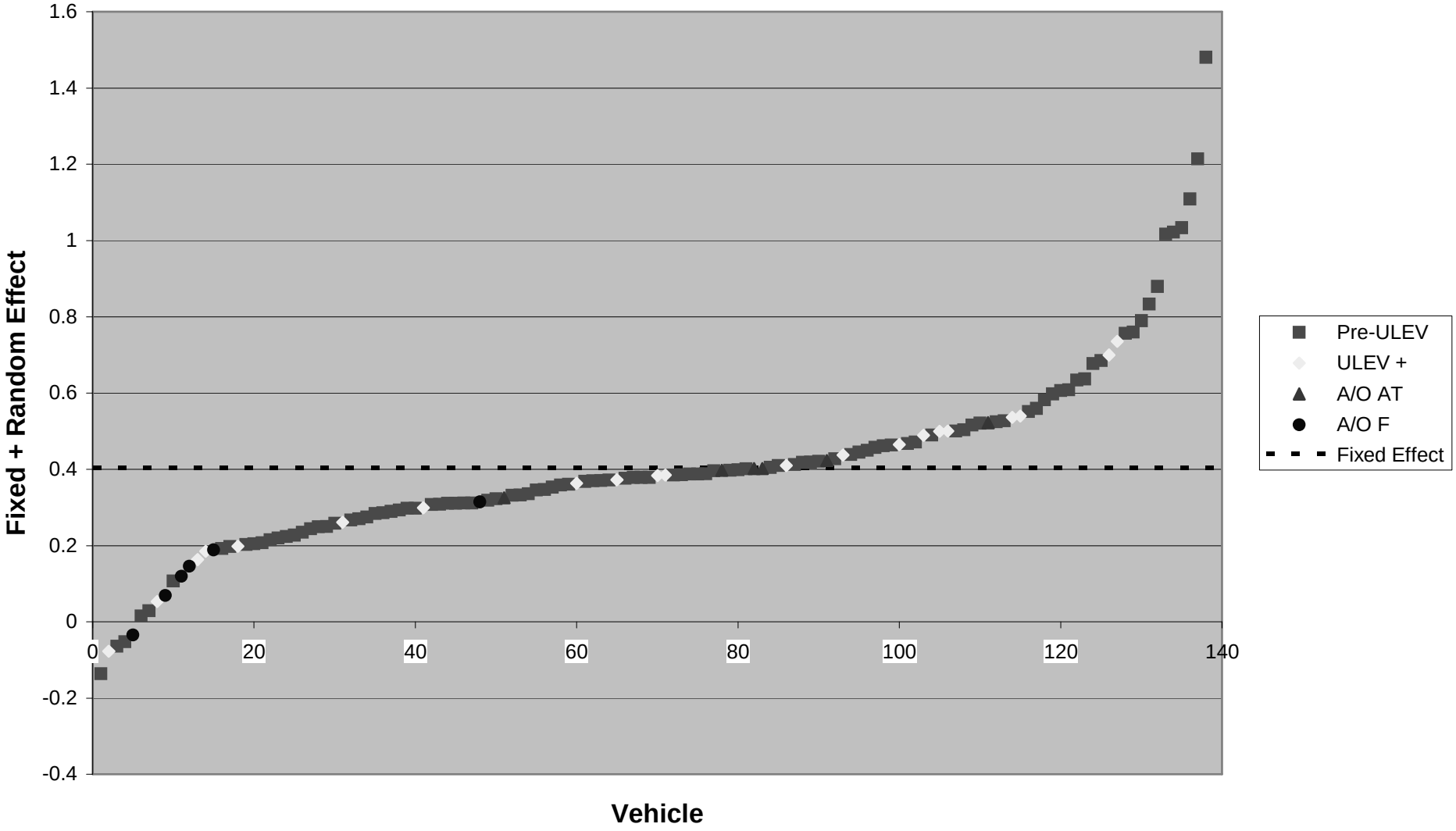
- Used CARB Stand Alone Tech 5 Models
  - THC: T50 Sq, Sulfur Sq, T90 x Oxy
  - NOx: Oxy Sq, Sulfur Sq, T90 x Oxy
- Plotted slopes for individual vehicles
  - Vehicle slope = Fixed effect + Random effect
  - Random effect = Vehicle x Fuel interaction
- Examine distribution of vehicle slopes for different groups
- Do different groups have different distributions?

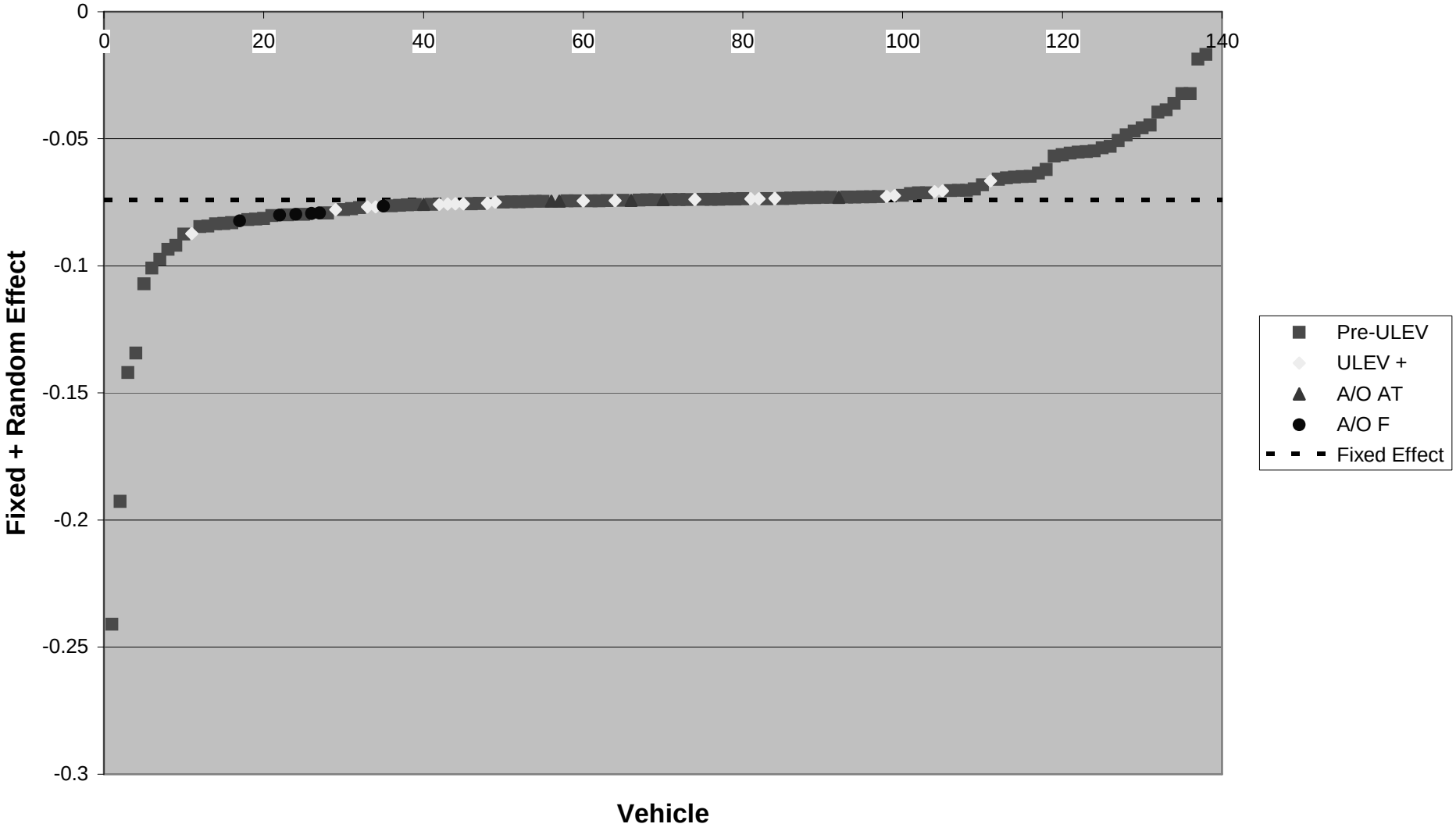
Notes for charts

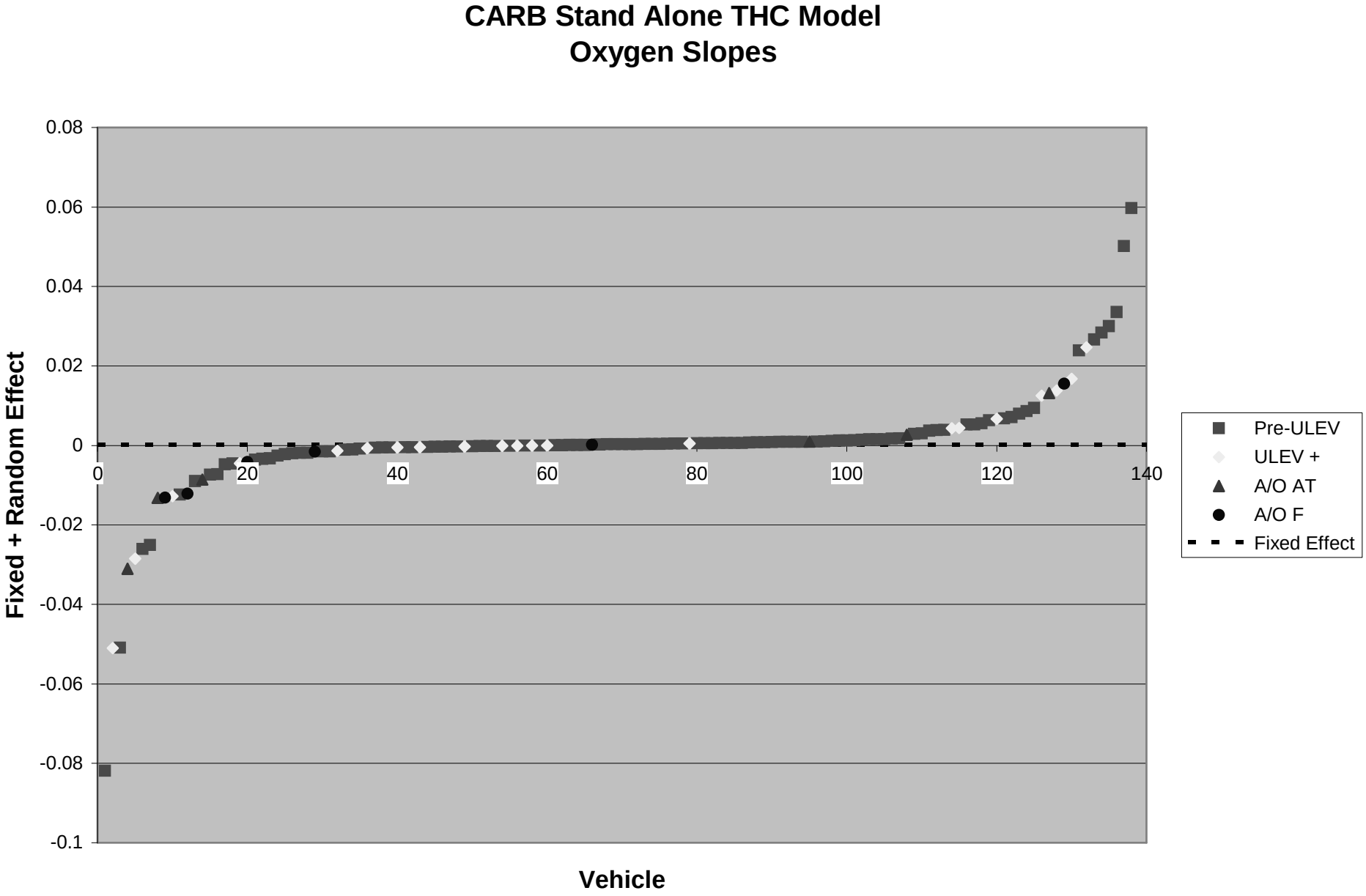
- ULEV+ = ULEV and SULEV
  - Definitions provided by AIR
  - PC vs. LDT?
- A/O AT = Auto/Oil Advanced Technology
- A/O F = Auto/Oil Tier 1 prototypes
- Pre-ULEV = Everything else in Tech 5


CARB Stand Alone THC Model
Sulfur Slopes
Fixed + Random Effect
2.5
2
1.5
1
0.5
0
-0.5
0
20
40
60
80
100
120
140
Vehicle
Pre-ULEV
ULEV +
A/O AT
A/O F
Fixed Effect

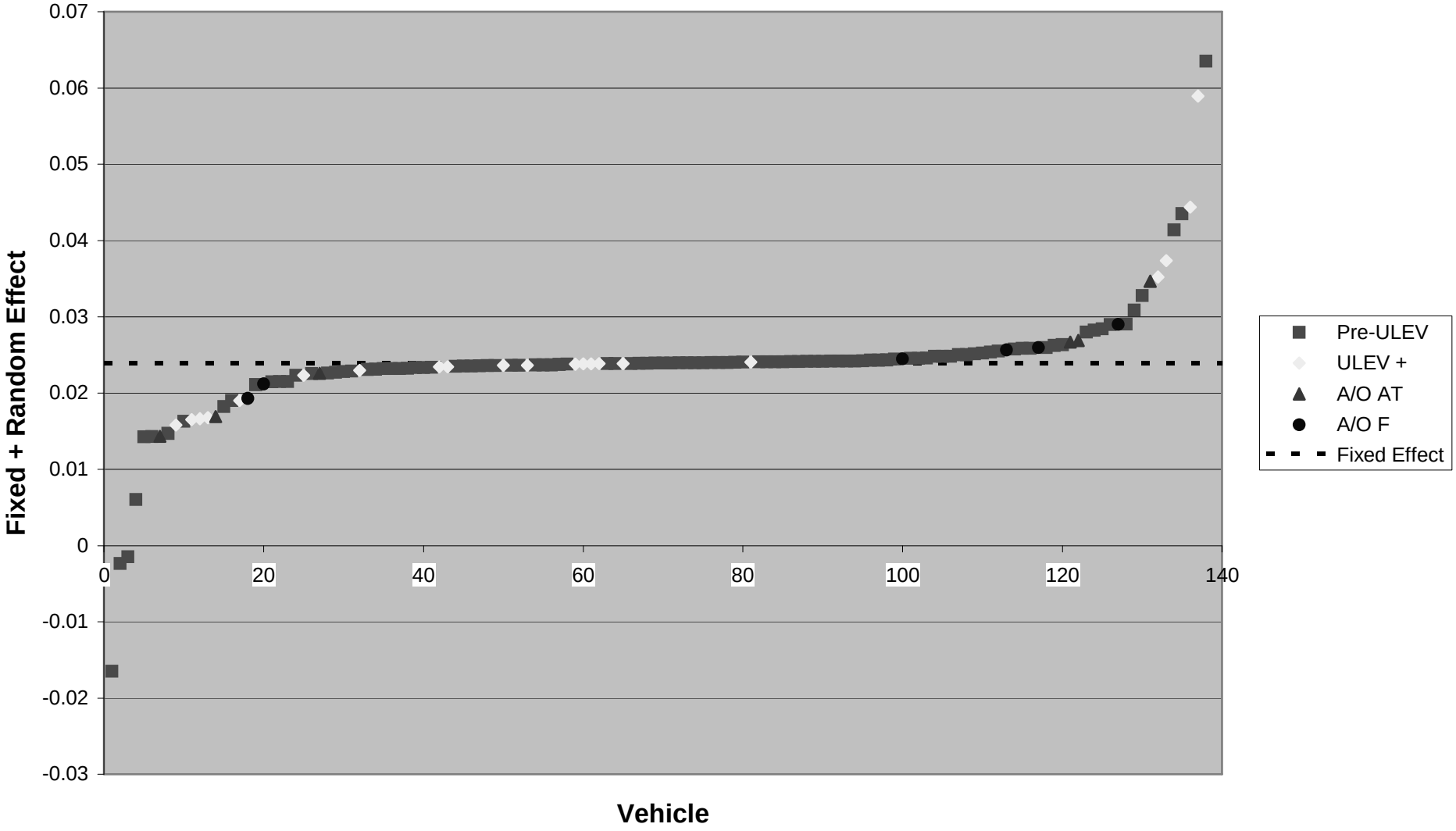
CARB Stand Alone NOx Model
Sulfur Slopes



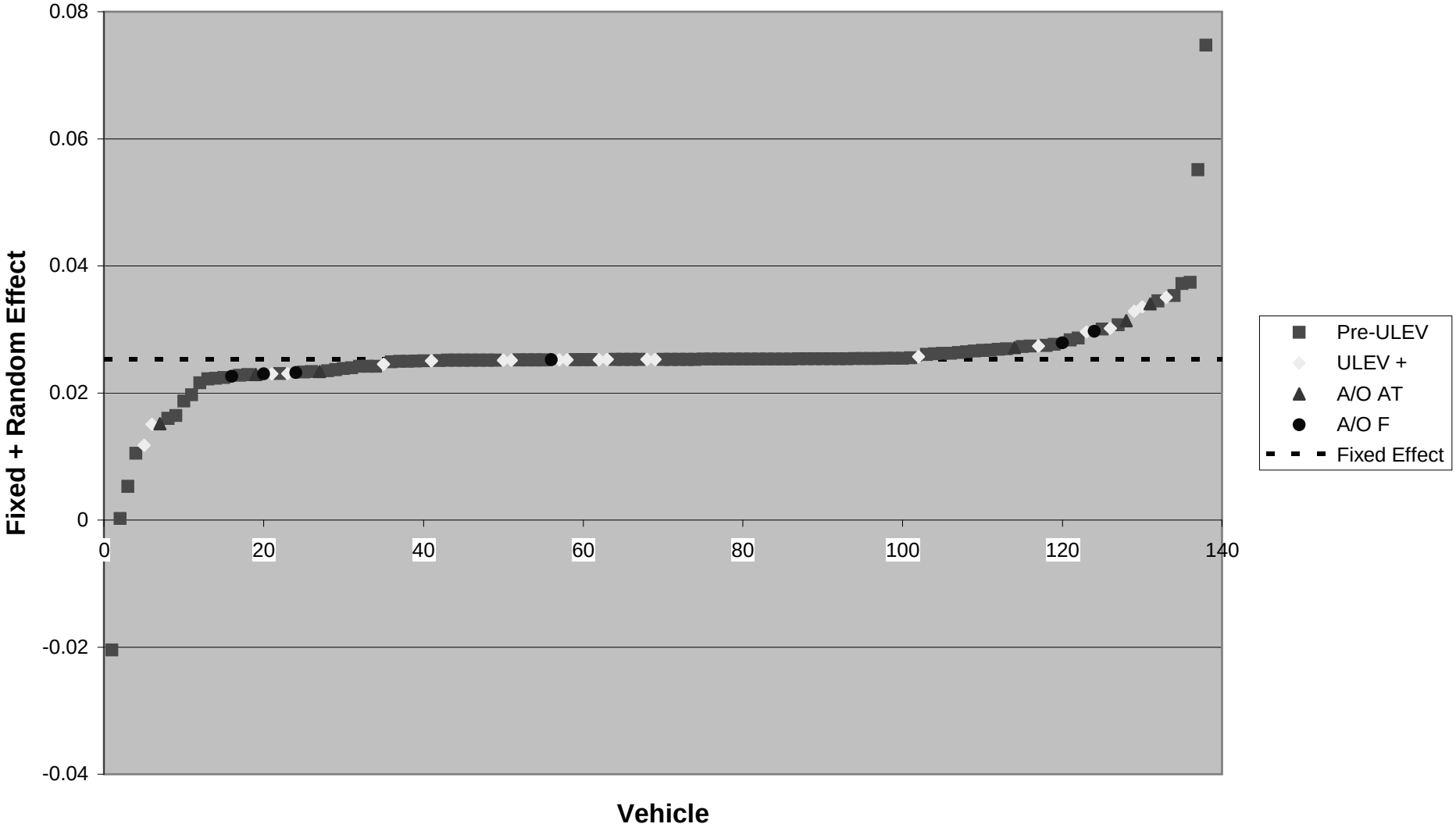

CARB Stand Alone NOx Model
Sulfur Squared Slopes
Fixed + Random Effect
0
-0.05
-0.1
-0.15
-0.2
-0.25
-0.3
0
20
40
60
80
100
120
140
Vehicle
Pre-ULEV
ULEV +
A/O AT
A/O F
Fixed Effect

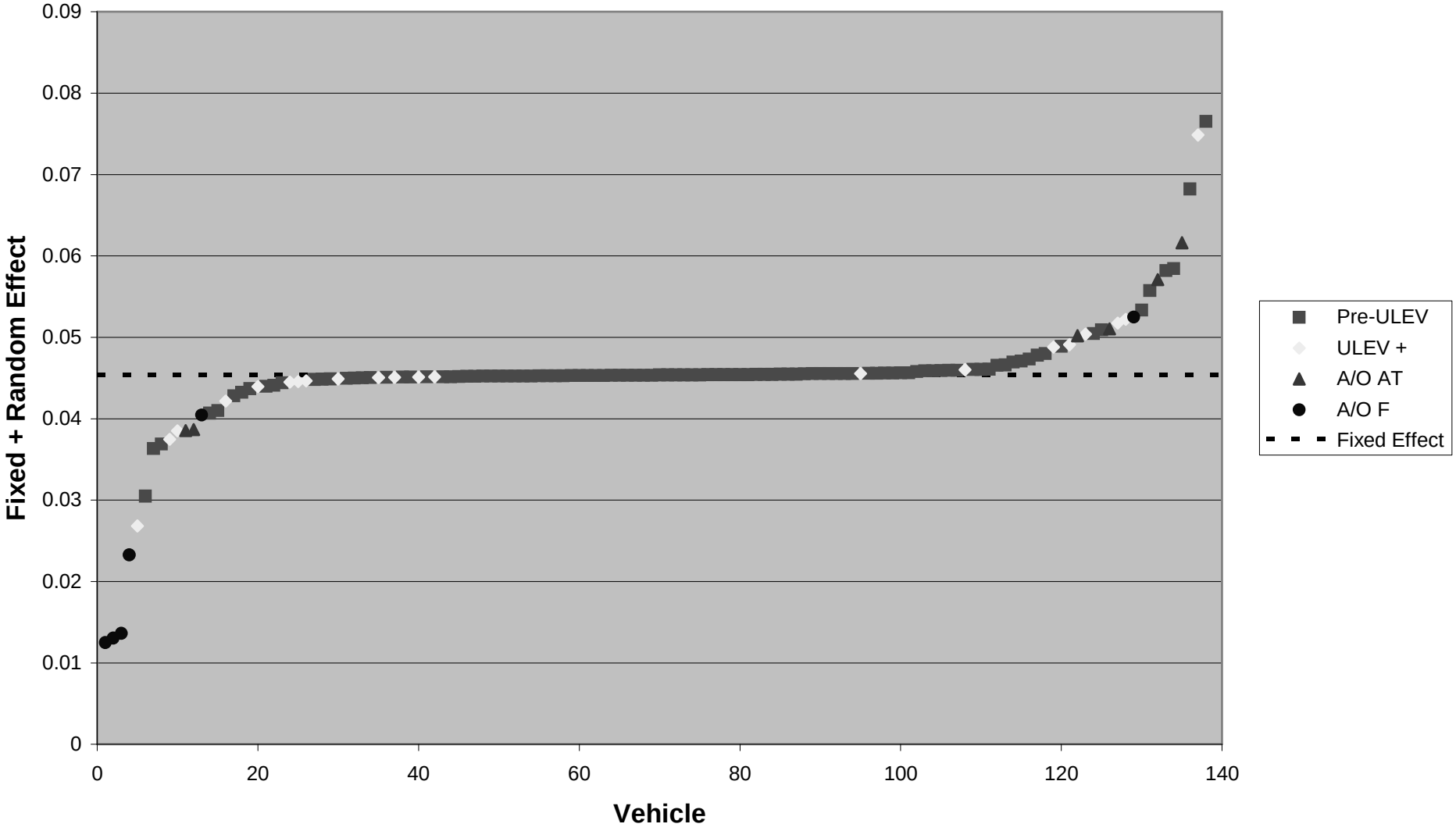

CARB Stand Alone THC Model
Oxygen Slopes
Fixed + Random Effect
0.08
0.06
0.04
0.02
0
-0.02
-0.04
-0.06
-0.08
-0.1
0
20
40
60
80
100
120
140
Vehicle
Pre-ULEV
ULEV +
A/O AT
A/O F
Fixed Effect

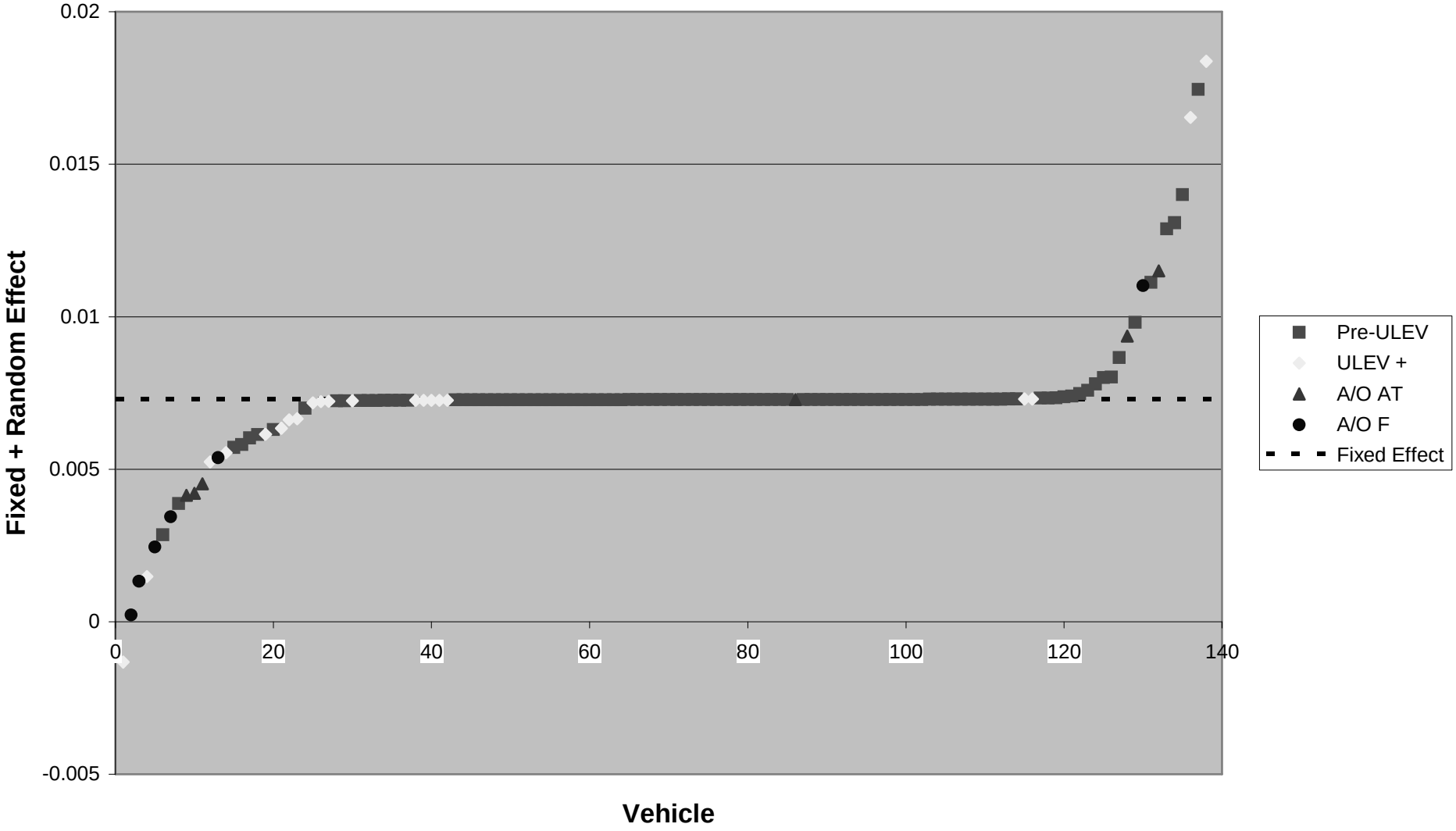
CARB Stand Alone NOx Model
Oxygen Slopes

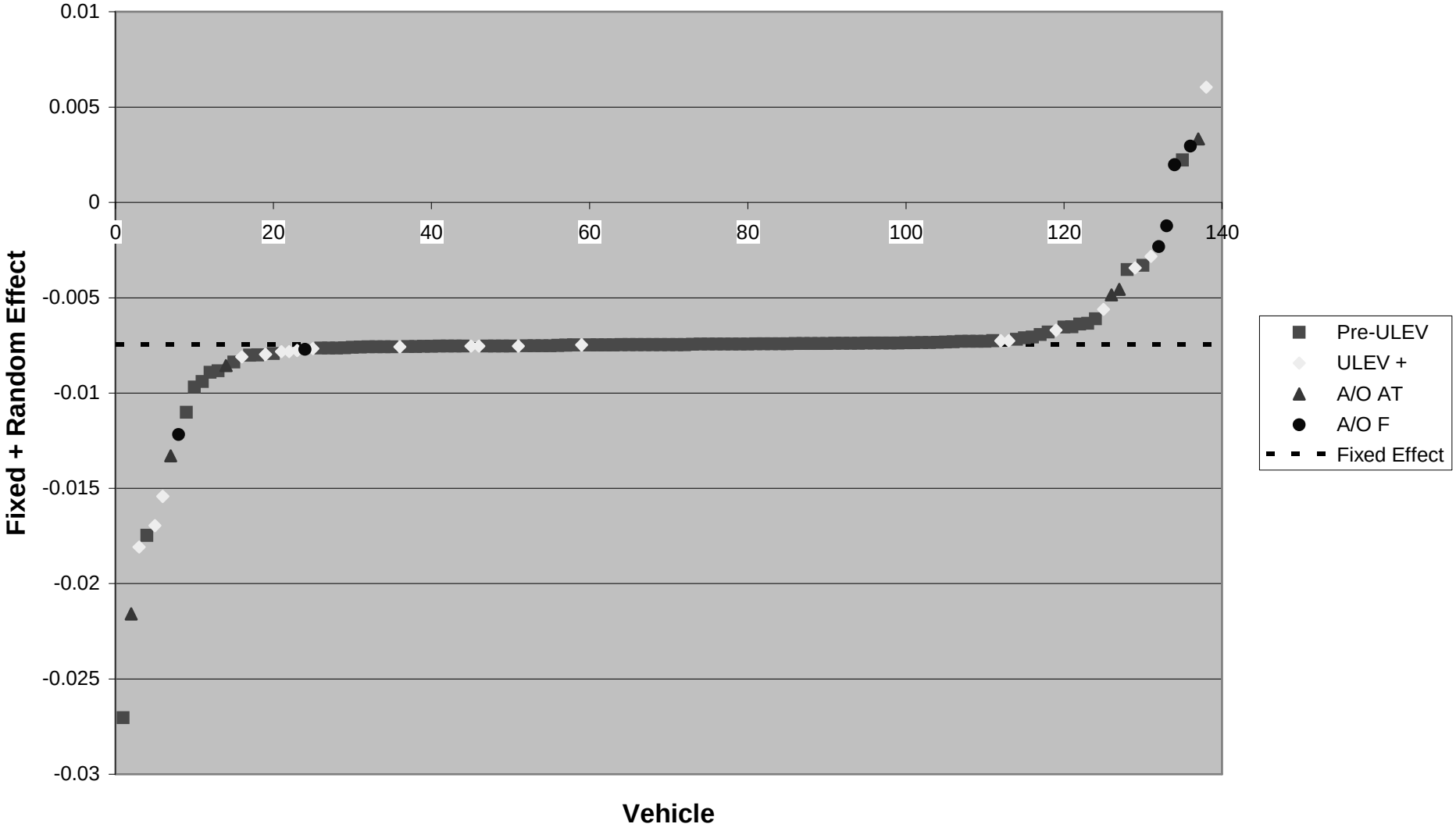


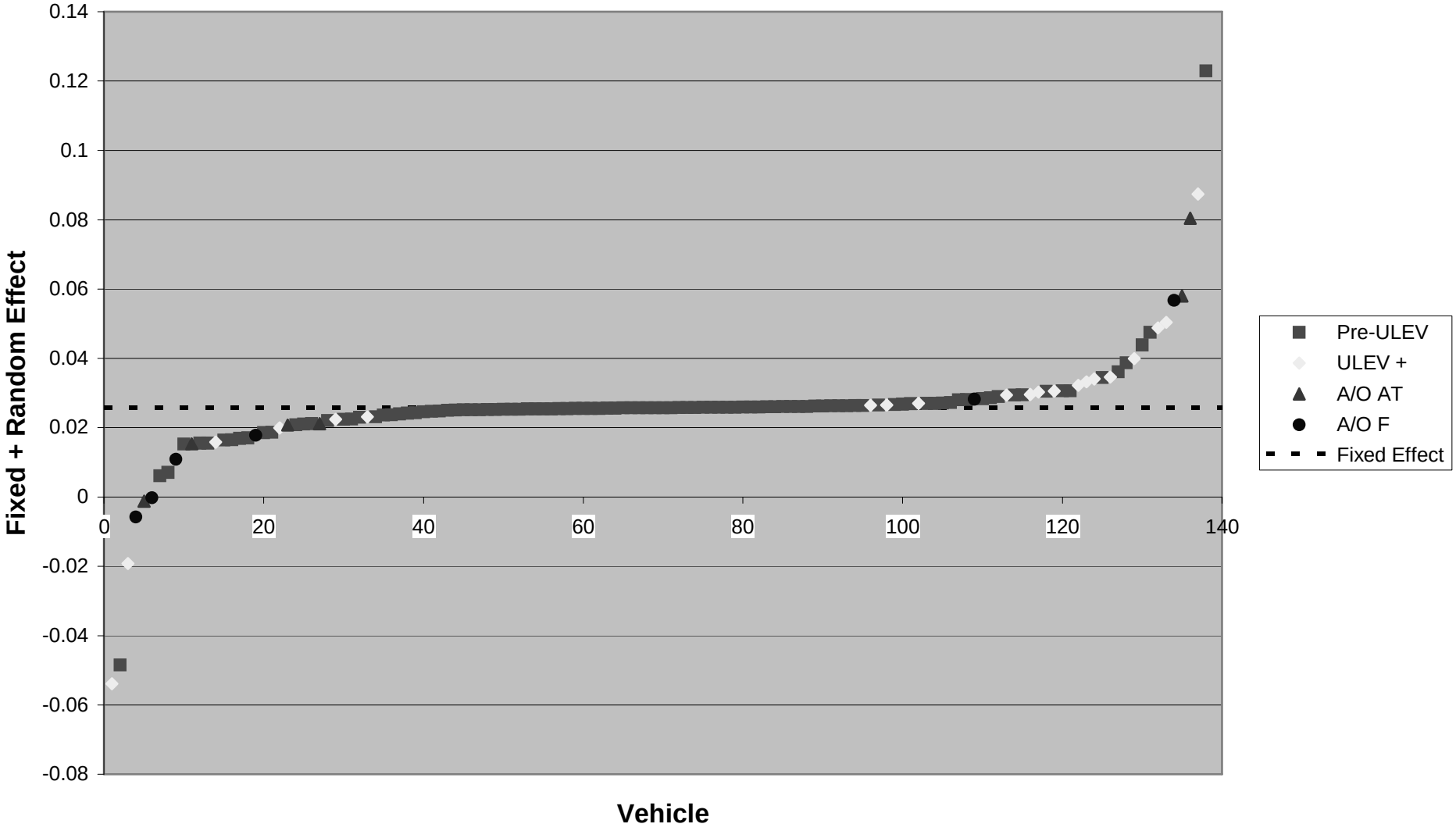
CARB Stand Alone NOx Model
Oxygen Squared Slopes

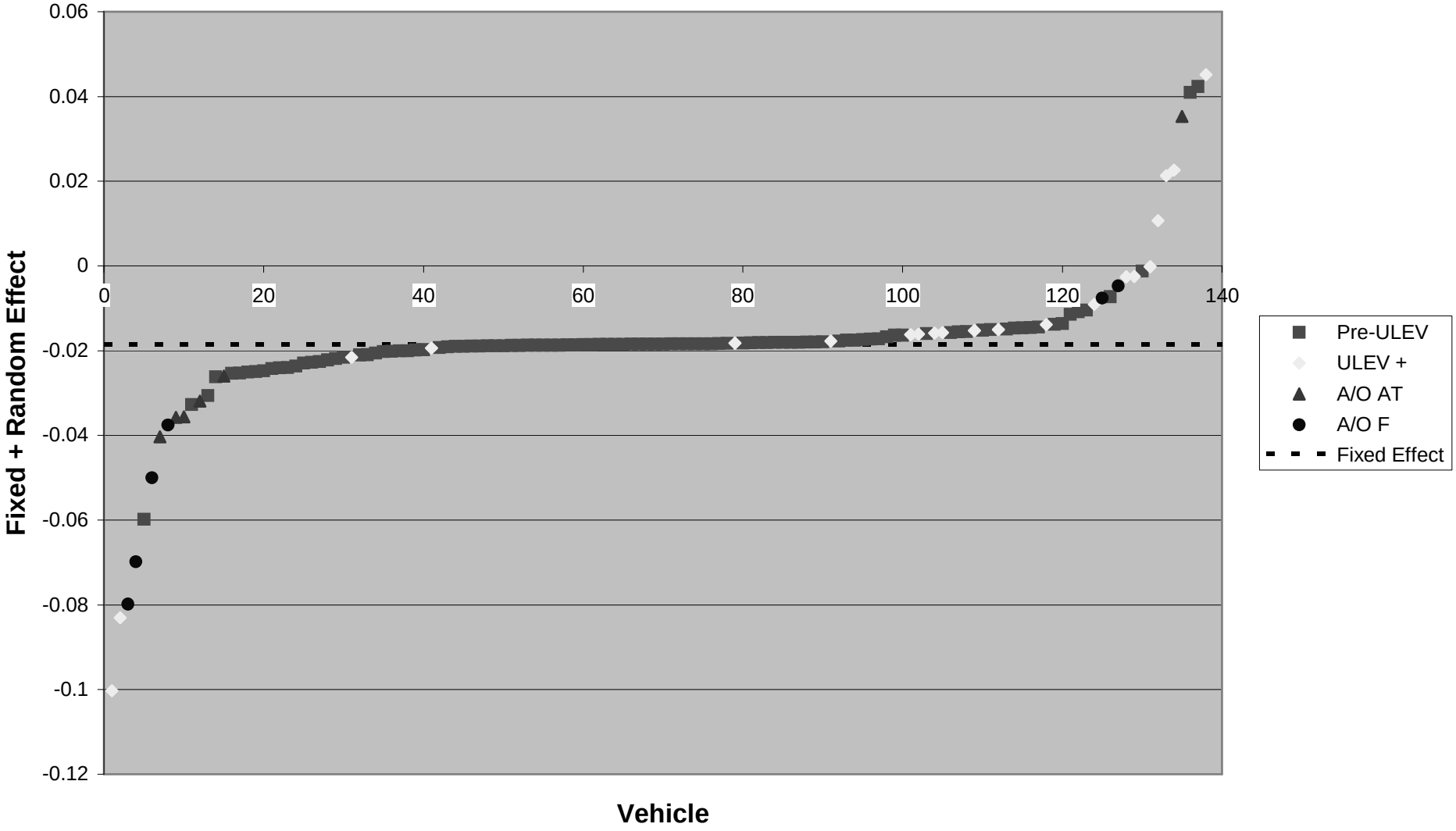


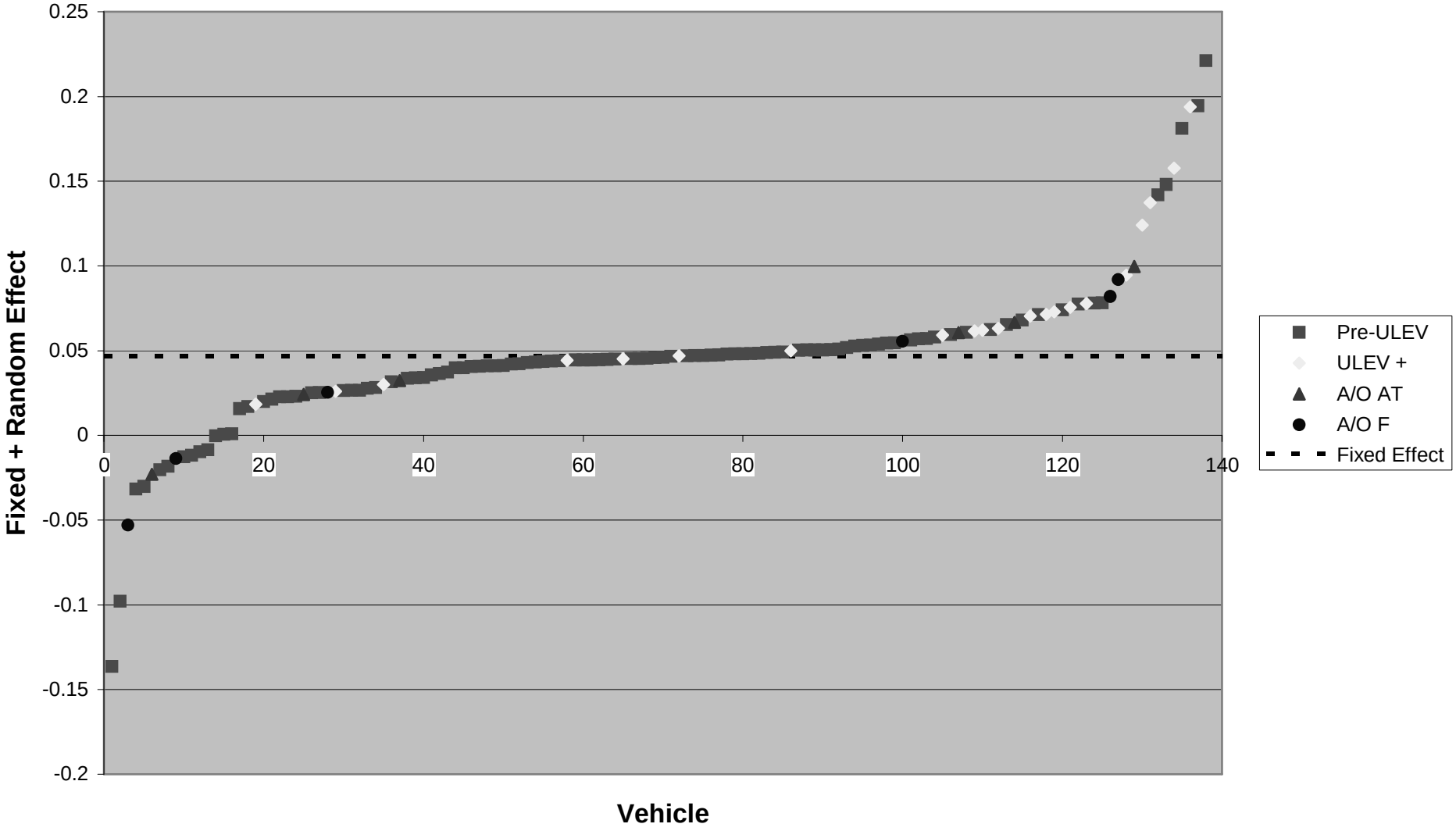

CARB Stand Alone THC Model
T50 Slopes
Fixed + Random Effect
0.09
0.08
0.07
0.06
0.05
0.04
0.03
0.02
0.01
0
0
20
40
60
80
100
120
140
Vehicle
Pre-ULEV
ULEV +
A/O AT
A/O F
Fixed Effect

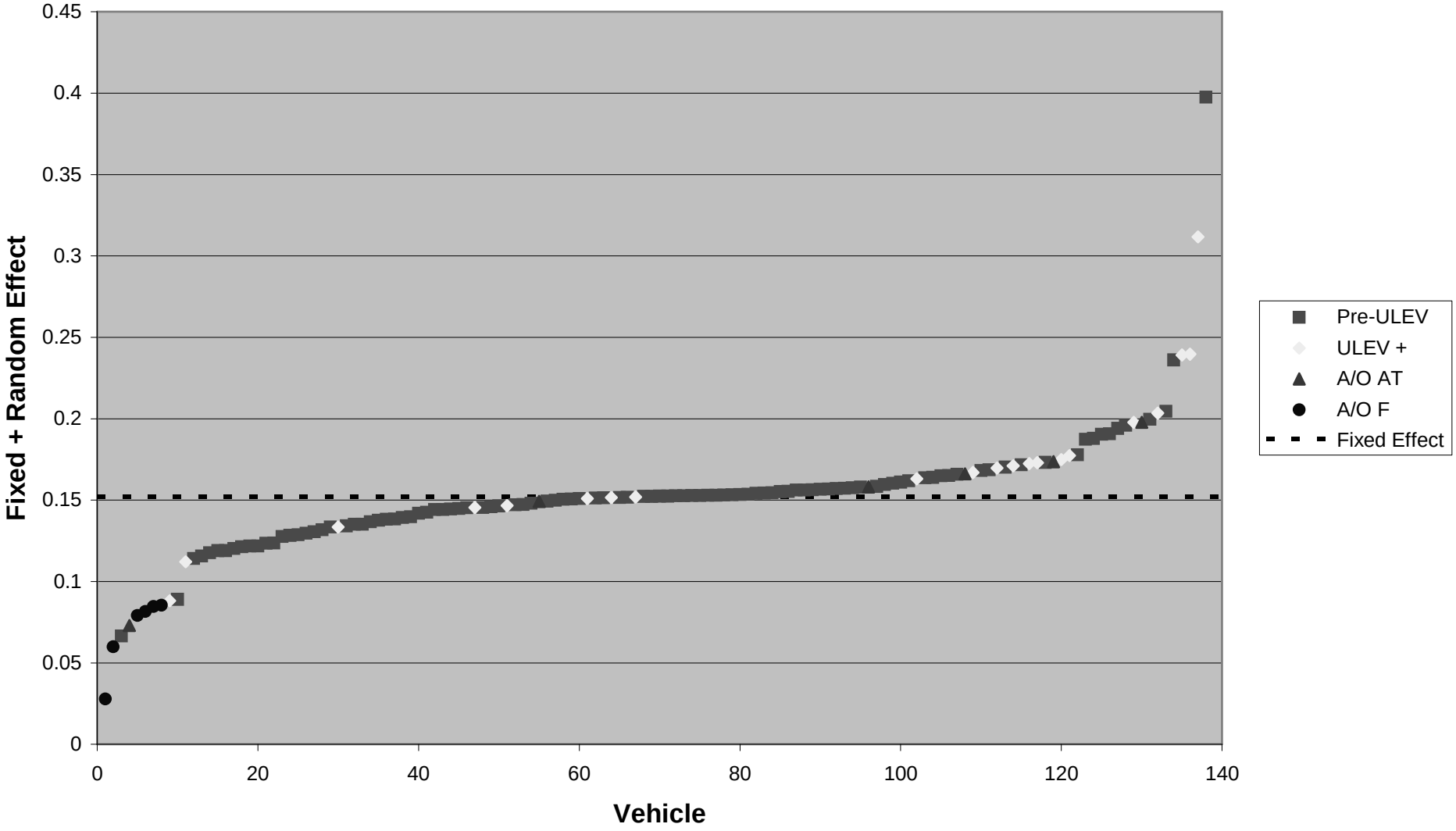

CARB Stand Alone THC Model
T50 Squared Slopes
Fixed + Random Effect
0.02
0.015
0.01
0.005
0
-0.005
0
20
40
60
80
100
120
140
Vehicle
Pre-ULEV
ULEV +
A/O AT
A/O F
Fixed Effect

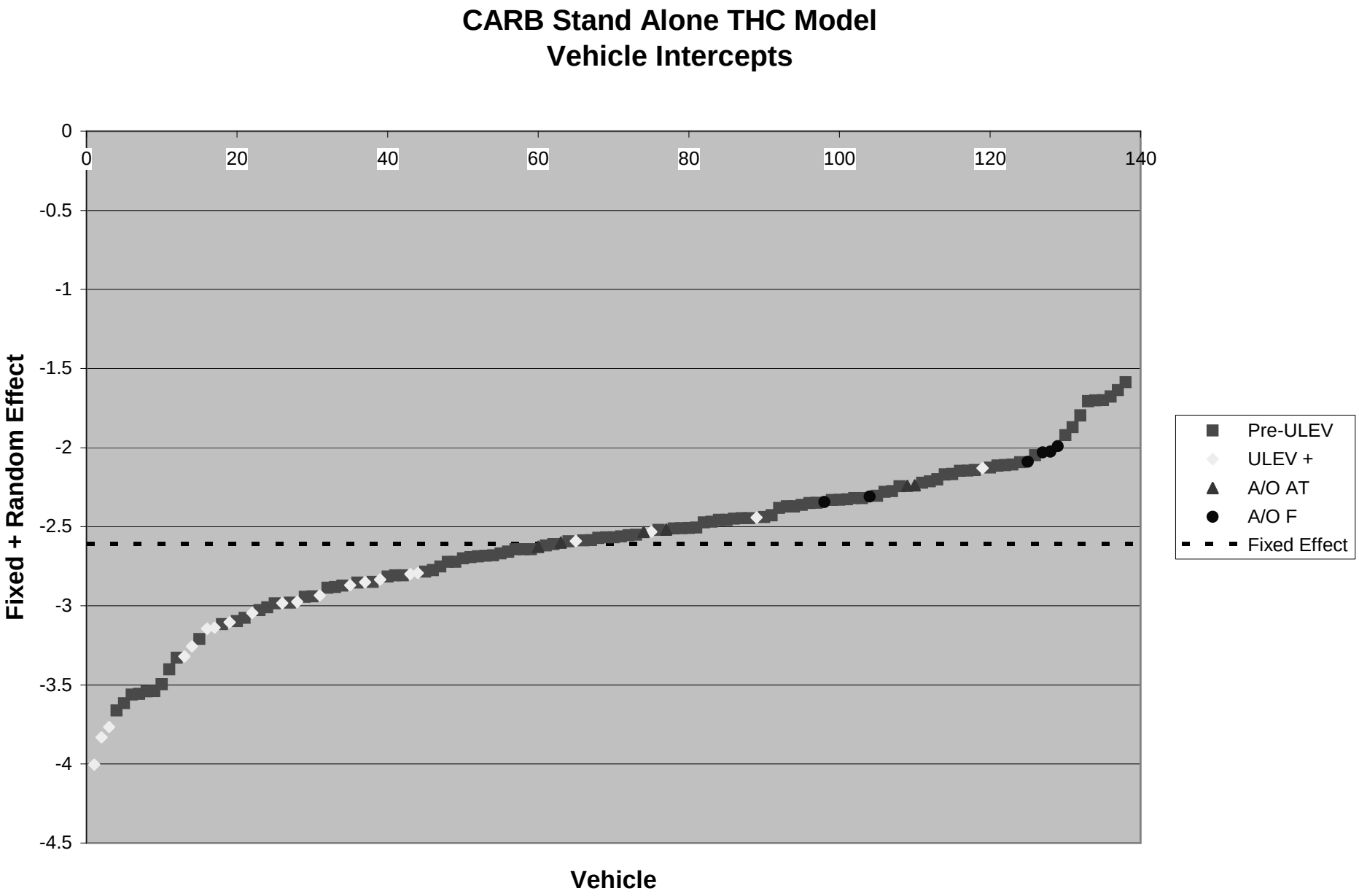

CARB Stand Alone NOx Model
T50 Slopes
Fixed + Random Effect
0.01
0.005
0
-0.005
-0.01
-0.015
-0.02
-0.025
-0.03
0
20
40
60
80
100
120
140
Vehicle
Pre-ULEV
ULEV +
A/O AT
A/O F
Fixed Effect

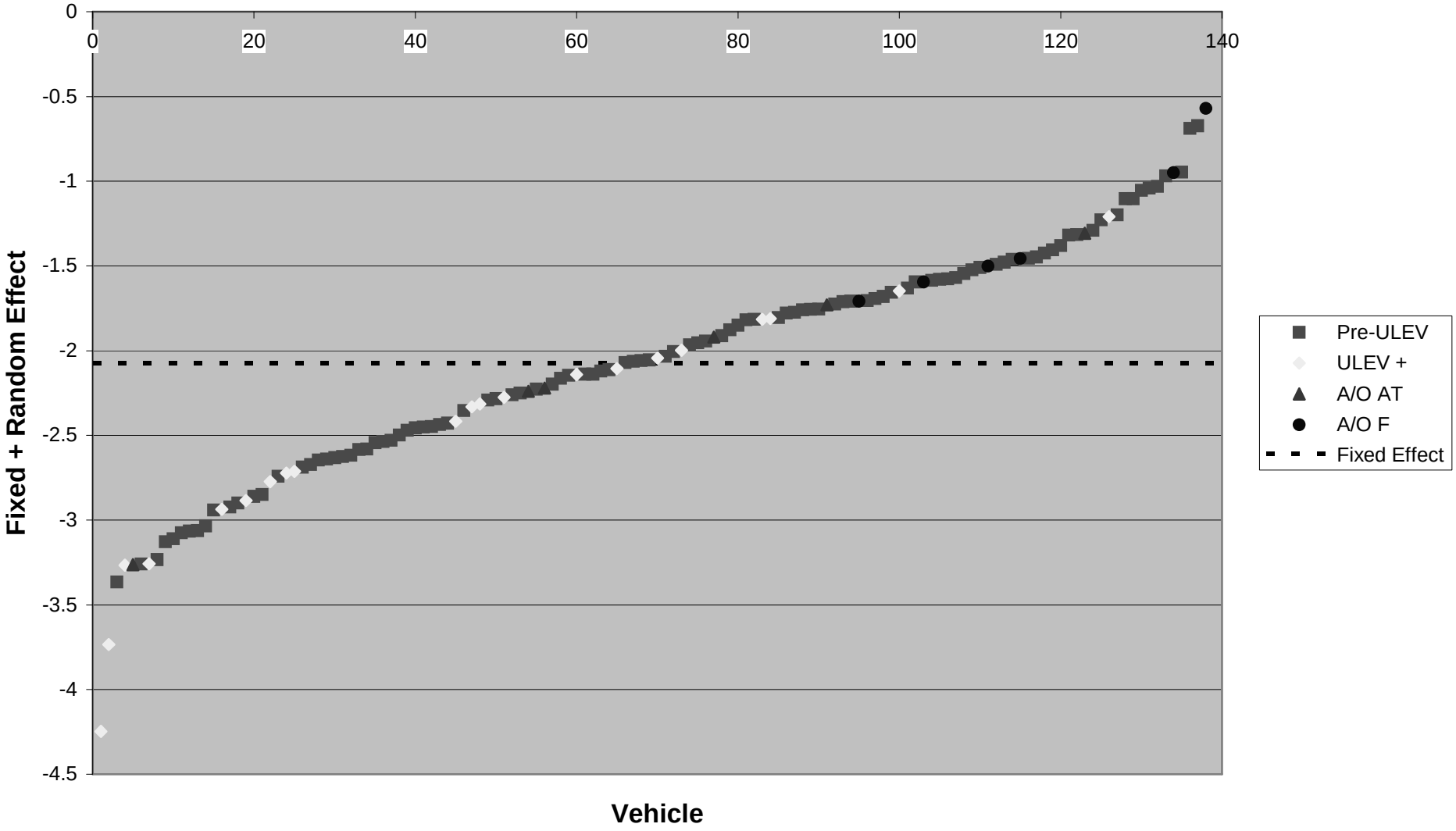

CARB Stand Alone THC Model
T90 Slopes
Fixed + Random Effect
0.14
0.12
0.1
0.08
0.06
0.04
0.02
0
-0.02
-0.04
-0.06
-0.08
0
20
40
60
80
100
120
140
Vehicle
Pre-ULEV
ULEV +
A/O AT
A/O F
Fixed Effect


CARB Stand Alone NOx Model
T90 Slopes
Fixed + Random Effect
0.06
0.04
0.02
0
-0.02
-0.04
-0.06
-0.08
-0.1
-0.12
0
20
40
60
80
100
120
140
Vehicle
Pre-ULEV
ULEV +
A/O AT
A/O F
Fixed Effect


CARB Stand Alone THC Model
Aromatics Slopes
Fixed + Random Effect
0.25
0.2
0.15
0.1
0.05
0
-0.05
-0.1
-0.15
-0.2
0
20
40
60
80
100
120
140
Vehicle
Pre-ULEV
ULEV +
A/O AT
A/O F
Fixed Effect


CARB Stand Alone NOx Model
Aromatics Slopes
Fixed + Random Effect
0.45
0.4
0.35
0.3
0.25
0.2
0.15
0.1
0.05
0
0
20
40
60
80
100
120
140
Vehicle
Pre-ULEV
ULEV +
A/O AT
A/O F
Fixed Effect


CARB Stand Alone THC Model
Vehicle Intercepts
Fixed + Random Effect
0
-0.5
-1
-1.5
-2
-2.5
-3
-3.5
-4
-4.5
0
20
40
60
80
100
120
140
Vehicle
Pre-ULEV
ULEV +
A/O AT
A/O F
Fixed Effect


CARB Stand Alone NOx Model
Vehicle Intercepts
Fixed + Random Effect
0
-0.5
-1
-1.5
-2
-2.5
-3
-3.5
-4
-4.5
0
20
40
60
80
100
120
140
Vehicle
Pre-ULEV
ULEV +
A/O AT
A/O F
Fixed Effect

Observations

- ULEV+ typically scattered across the overall vehicle distribution
- Where there was some uneven distribution, there was still considerable overlap
- ULEV+ do not appear to respond differently to fuel changes in the data
- Follow-on work: Examine studies that include both ULEV+ and Pre-ULEV

Concerns about process

- Format has been:
  1. Discussion among statistical group
  2. Determination of consensus
  3. Raise issue at workshop if no consensus
- This issue has not been thoroughly discussed within the statistical group
- We need to take the time to get this model right